

We claim:

1. A movable welding apparatus for forming a weld pass, said apparatus comprising:

a carriage for movement along a track mounted to a surface of an object to be welded, the carriage having a direction of movement lengthwise relative to the weld pass to be formed;

a welding head mounted to said carriage;

said welding head having a first degree of freedom permitting cross-wide motion thereof relative to the direction of motion of the carriage;

said welding head having a second degree of freedom permitting rocking motion of said welding head;

said apparatus being operable to vary position of said welding head in each of said first and second degrees of freedom while said welding head is in operation forming the weld pass.

2. The moveable welding apparatus of claim 1 wherein said apparatus is movable in both said first and second degrees of freedom simultaneously.

3. The movable welding apparatus of claim 1, wherein said first degree of freedom is a transverse linear degree of freedom.

4. The movable welding apparatus of claim 1, wherein said second degree of freedom is a pivoting degree of freedom.

5. The movable welding apparatus of claim 4, wherein said second degree of freedom is a pivoting degree of freedom permitting cross-wide oscillation of said welding head relative to the direction of movement of the carriage.

6. The movable welding apparatus of claim 1 wherein said first degree of freedom is a transverse linear degree of freedom, said second degree of freedom is a transverse pivoting degree of freedom, and said welding head is movable simultaneously with respect to both said first and second degrees of freedom to produce a complex cross-wide rocking motion of said welding head relative to the direction of travel of said carriage.

7. The movable welding apparatus of claim 1 wherein said welding head has a third degree of freedom permitting variation of spacing of said welding head normal to the surface.

8. The movable welding apparatus of claim 1 further comprising a controller operable to actuate the first and the second transport mechanisms simultaneously to change a vertical position of a pivoting point of said welding head in accordance with a pre-determined trajectory.

9. The movable welding apparatus of claim 1 further comprising feedback apparatus mounted to monitor operating parameters of said welding apparatus during operation thereof, and control apparatus, said control apparatus being operable in response to signals from said feedback apparatus to vary position of said welding head during operation thereof.

10. A welding apparatus comprising:

a carriage for movement along a track adjacent to a location for forming a weld pass;

a welding torch movably mounted to said carriage;

a first transport mechanism operable to move said torch transversely relative to the movement of said carriage;

a second transport mechanism operable angularly to move said torch relative to the movement of said carriage; and

said first and second transport mechanisms being operable to move said torch relative to said carriage during operation of said torch to form said weld pass.

11. The welding apparatus of claim 10 wherein said first and second transport mechanisms are simultaneously operable during operation of said torch.

12. The welding apparatus of claim 10 wherein said first and second transport mechanisms are simultaneously operable to oscillate said welding torch during formation of the weld pass.

13. The welding apparatus of claim 12 wherein said first and second transport mechanisms are simultaneously operable to oscillate said torch transversely relative to movement of said carriage while forming the weld pass.

14. The welding apparatus of claim 10, further comprising the third transport mechanism operable to establish a contact-to-work offset of said torch.

15. The welding apparatus of claim 14 wherein said third transport mechanism is operable to vary said contact to work offset.

16. The welding apparatus of claim 15 wherein said third transport mechanism is operable while said carriage is in motion.

17. The welding apparatus of claim 15 wherein operation of said first, second, and third transport mechanisms is electronically controlled.

18. The welding apparatus of claim 15 wherein said first, second and third transport mechanisms are simultaneously operable.

19. The welding apparatus of claim 10 wherein said second transport mechanism is a pivoting mechanism for pivoting said torch about an axis aligned with the direction of movement of said carriage.

20. A welding apparatus for forming weld pass seams between two abutting work pieces, said apparatus comprising:

a carriage for following a path along a surface of one of the abutting work pieces;

a torch movably mounted to a carriage;

a first transport assembly operable to linearly translate said torch transversely relative to the path of said carriage;

a second transport assembly operable to pivot said torch about an axis parallel to the path of said carriage; and, while said torch is in operation,

said first and second transport assemblies being simultaneously operable laterally to oscillate said torch during formation of a weld pass.